IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claims 1-10 (canceled)

11.(new) A non-periodic echelle structure for use in an optical device to achieve any arbitrary desired narrow-band temporal optical transfer function H(v) between the device's single-mode input and output apertures, where v represents frequency in Hz and H(v) is a complex function having an amplitude A(v) and a phase θ(v), the transfer function being not achievable by means of a periodic echelle structure; the non-periodic echelle structure comprising a plurality of contiguous reflective facets, unequally spaced along any dimension, and of unequal width.

12.(new) An optical device for realizing an arbitrary narrow-band temporal optical transfer function; the device comprising:

entrance and exit apertures which are spatially single-mode over the prescribed wavelength range of operation;

a non-periodic echelle structure having a plurality of contiguous reflective facets unequally spaced along any dimension, and of an unequal width; and

a means of collimating the single-mode entrance and exit apertures such that the input beam, resulting from the collimation of the single-mode entrance aperture, is incident upon each facet of the non-periodic echelle structure at a common angle of incidence, and the output beam, resulting from the collimation of the single-mode exit aperture, is also incident upon each facet of the non-periodic echelle structure at a common angle of incidence, input and output beams intersecting over an area encompassing all the reflective facets of said non-periodic echelle structure.

13.(new) A method of fabricating a non-periodic echelle structure having a plurality of reflective facets of unequal spacing along any dimension, and of an unequal width, for use in an optical system having input and output apertures; the method comprising the steps of:

a) selecting an appropriate sampling interval T seconds, where T is not longer than one-half the reciprocal of a frequency range, in Hz, over which a desired narrow-band temporal optical transfer function H(v) is to be uniquely specified;

b) selecting a number M of echelle facets to be illuminated by an input optical beam, based upon the chosen sampling interval T and the minimum resolvable spectral feature W, in Hz, present in either the amplitude A(v) or the phase θ(v), where $M \geq \frac{1}{WT}$ rounded up to the nearest integer;

c) specifying the frequency vc, in Hz, about which H(v) is approximately centered;

d) determining the vector $\vec{h}$ of complex impulse response coefficients, the m'th coefficient, $h_m = \int_{vc-\frac{1}{2T}}^{vc+\frac{1}{2T}} H(v)e^{j2\pi vmT}dv$, having an amplitude a_m and a phase φ_m, where j = $\sqrt{-1}$ is the imaginary unit and $0 \le m \le M-1$;

e) normalizing the complex impulse response amplitudes, by multiplying each by a common factor K, such that $\sum_{m=0}^{M-1} K \cdot a_m = 1$;

f) starting at one edge of the input beam, at x = 0, selecting the transverse width w_0 of a first illuminated facet, corresponding to m = 0, such that the fraction of the input beam energy reflected by said facet corresponds precisely to Ka_0, whereupon said facet is located in the transverse position between x = 0 and x = w_0;

g) selecting the transverse width w_1 of the next illuminated facet in the array, corresponding to m = 1, such that the fraction of the input signal energy reflected by said next facet corresponds precisely to Ka_1, whereupon said next facet is located in the transverse position between x = w_0 and x = $w_0 + w_1$;

h) iterating step g) M-2 times, to find the transverse widths and transverse positions for the remaining M-2 illuminated facets;

i) setting the precise longitudinal position, along the direction of propagation of the input beam, of the center of the m'th illuminated facet, such that the relative delay, compared to any arbitrary time reference, experienced by an optical ray incident upon said facet and collected at the exit aperture is $\Delta t_m = mT + \varphi_m /(2\pi\nu c)$.

14.(new) The method of fabricating the non-periodic echelle structure recited in claim 13, generalized to geometries other than collimated input and output beams.

15.(new) The non-periodic echelle structure recited in claim 11 wherein said structure is replicated from a master.

16.(new) The non-periodic echelle structure recited in claim 11 wherein each said facet being illuminated is coated for increased reflectivity.

17.(new) The method recited in claim 14 wherein at least one of said entrance and exit apertures comprises a single-mode optical fiber.

18.(new) The method recited in claim 14 further comprising the steps of confining said optical beam in at least one direction with a single mode slab waveguide and wherein said non-periodic echelle structure is formed in an edge of said slab waveguide.